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SINHALOHELEA, A NEW GENUS OF PREDACEOUS MIDGE FROM SRI LANKA (DIPTERA: CERATOPOGONIDAE)

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Abstract.—**Sinhalohelea gansi,** a new genus and species of predaceous midge of the tribe Ceratopogonini is described and illustrated. This new genus forms the sister group of four genera (*Brachypogon, Ceratoculicoides, Nannohelea, Rhynchohelea*). Characters are discussed that allow *Sinhalohelea* to be distinguished from morphologically similar taxa.

Key Words: Diptera, Ceratopogonidae, Ceratopogonini, *Sinhalohelea,* new genus, Sri Lanka, predaceous midges

The predaceous midges of the tribe Ceratopogonini have recently received comprehensive treatment by Wirth and Grogan (1988), in which they illustrated and provided a key for 45 extant genera and a list of species for each genus. Four recently described genera were not included in that review: *Chimaerohelea* Debenham (1987) from Australia, *Bothamia* Meiswinkel (1987) from South Africa, *Neohelea* Clastrier (1988) from Guinea, and *Boreohelea* Clastrier and Delecolle (1990) from Guinea.

We recently examined specimens collected in 1974 from Sri Lanka and now housed in the National Museum of Natural History in Washington, D.C., USA (USNM). These specimens represent a new genus of predaceous midges of the tribe Ceratopogonini, which we describe herein.

For an explanation of general ceratopogonid terms, see Downes and Wirth (1981); for special terms dealing with the tribe Ceratopogonini, see Wirth and Grogan (1988). Actual values for antennal flagellomere and palpal proportions may be obtained by multiplying by 0.000148 mm.

Sinhalohelea Grogan and Borkent, New Genus

Type-species.—*Sinhalohelea gansi* Grogan and Borkent, new species.

Diagnosis.—The only genus in the tribe Ceratopogonini with the following combination of characters. Eyes pubescent, contiguous. Antenna with sensilla coeloconica on flagellomere 1; male flagellum with all flagellomeres separate. Palpus 5-segmented; segment 3 moderately slender with a well defined pit. Female wing with single long radial cell, costa extending 0.71–0.75 of wing length; vein M2 absent or only apical portion present. Male wing with two small radial cells and distal portion of M2 present. Legs of female moderately stout, unarmed; tarsomere 4 of fore leg swollen, cylindrical on mid and hind legs, all bearing apical sinuate setae; fore claws large, unequal; mid and hind claws small, equal sized, with small basal inner tooth on each talon. Katepisternum with single lateral seta. Female abdomen with segment 8 entire, not divided by pleura; two spermathecae. Male genitalia small, reduced in size, without apicolateral processes on tergite 9; aedeagus broadly triangular; parameres separate.

Etymology.—The genus name is a reference to the Sinhalese, the non-Dravidian majority people of Sri Lanka.

Comparison with similar genera.—*Sinhalohelea, Brachypogon* Kieffer, *Ceratoculicoides* Wirth and Ratanaworabhan, *Nannohelea* Grogan and Wirth and *Rhynchohelea* Wirth and Blanton are apparently closely related by virtue of the fact that they all possess at least one seta on their katepisternum (Fig. 9). Of these other four genera, *Brachypogon* most closely resembles *Sinhalohelea,* but differs in having a wing with a shorter costa that extends less than 0.65 of wing length, the radial cells of which are extremely variable, from both cells being obsolete to one or two small cells present, and flagellomeres 2–11 of the male antenna are fused. In addition, if the female fore claws are enlarged in *Brachypogon,* the mid and hind claws usually are enlarged as well.

Ceratoculicoides differs from *Sinhalohelea* in having the posterior margin of the anepisternum dissected and usually bearing one or more setae on posterior extensions, and only flagellomeres 6–11 of the male antenna fused.

Rhynchohelea differs from *Sinhalohelea* by its shorter costa (costal ratio 0.41 or less), short truncate labium bearing setae on cuticular extensions, and the female antenna reduced to 12 flagellomeres (males are unknown for this genus).

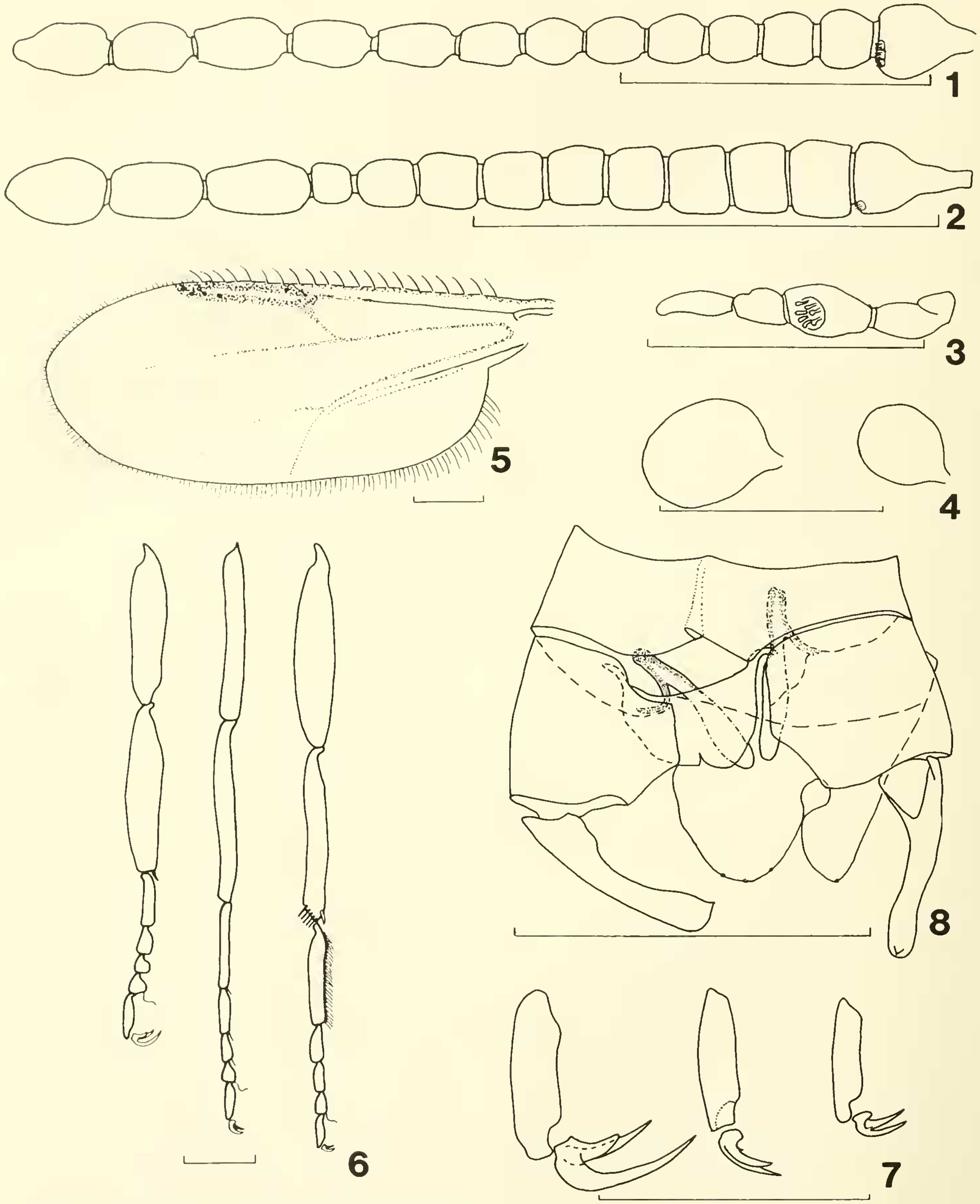
The four genera forming the sister group of *Sinhalohelea* are keyed in Borkent (1991).

Afrohelea, Alluaudomyia, Diaphanobezzia, Fittkauhelea, Parabezzia, and *Stilobezzia* (*Eukraiohelea*) all have wings with a single long radial cell but differ from *Sinhalohelea* in possessing a well developed vein M2 and lacking sensilla coeloconica on flagellomere 1. *Baeodasymyia, Baeohelea,* some *Camptopterohelea, Leptohelea* and *Nannohelea* all have wings with a single radial cell but the cell is of a different configuration than *Sinhalohelea*; these small reduced genera also have very short small claws (single in *Camptopterohelea*) and a reduced 2 or 3-segmented palpus. All other genera of the tribe Ceratopogonini differ from *Sinhalohelea* in either having two radial cells in their wing or lacking sensilla coeloconica on flagellomere 1 (Wirth and Grogan 1988).

***Sinhalohelea gansi* Grogan and Borkent, NEW SPECIES**

Figs. 1–8

Female.—Wing length 0.73 (n = 3); breadth 0.33, 0.32–0.33 (n = 3) mm. *Head:* Dark brown. Eyes pubescent, contiguous. Antenna with short scape bearing 3–4 setae; pedicel very dark brown; flagellum (Fig. 1) with flagellomere 1 bearing 3 apical sensilla coeloconica, all flagellomeres bearing subbasal whorl of sensilla chaetica, proximal 8 with subapical pair of long sensilla trichodea, distal 5 with subapical short sensilla trichodea; lengths of flagellomeres in proportion of 23-12-12-12-13-14-14-15-19-19-22-19-23; antennal ratio 0.90, 0.89–0.93 (n = 3). Clypeus with 3 pairs of submarginal setae. Palpus (Fig. 3) moderately long, segment 5 extending beyond tip of proboscis; segment 3 with well defined circular pit bearing capitate sensilla; lengths of segments in proportion of 4-9-10-6-8; palpal ratio 1.82. Mandible with 8 large curved teeth. *Thorax:* Dark brown. Scutum with shallow humeral pits, covered with minute pubescence, sparse large setae in more or less longitudinal rows; scutellum with 4 bristles. Legs (Fig. 6) with fore, hind femora thicker than mid femur; fore tibia nearly twice as thick as mid, hind tibiae, hind with apical plumose spur, comb with 5–6 setae; tarsi light brown on proximal 4 tarsomeres, these bearing a pair of apical spines, hind tarsomere 1 with well developed palisade setae, tarsomere 3, 4 of fore leg swollen, tarsomere 4 of mid, hind legs cylindrical,



Figs. 1–8. *Sinhalohelea gansi*. 1, female flagellum; 2, male flagellum; 3, female palpus; 4, spermathecae; 5, female wing; 6, female legs; 7, female tarsomeres 5 and claws; 8, male genitalia. Scales = 0.1 mm.

tarsomere 4 of all legs bearing pair of sinuate apical setae, tarsomere 5 of fore leg slightly enlarged with large subequal claws, largest talon bearing a large basal tooth, tarsomere 5 of mid, hind legs slender bearing small equal sized claws with small basal inner teeth (Fig. 7). Wing (Fig. 5) membrane lightly infuscated, covered with microtrichia only, macrotrichia restricted to wing margin and a few scattered along radius; wing moderately broad, 2.3 times longer than broad, anal lobe well developed; veins dark brown, one long slender radial cell present, r-m crossvein set at oblique angle, M1 obsolete on extreme apex near wing tip, M2 absent or present apically, cubitus forking just beyond level of r-m crossvein, forks obsolete at extreme tips, anal veins clearly marked; costal ratio 0.73, 0.71–0.75 (n = 3). Halter brown. *Abdomen:* Brown. Segment 8 not divided by pleura, forming a continuous ring; sternite 9 divided medially, each half with slender tip directed slightly posteriorly; sternite 10 with pair of large setae; 2–3 ovoid spermathecae with short necks (Fig. 4).

Male.—Wing length 0.57; breadth 0.24 mm. Smaller but otherwise similar to female with the following notable sexual differences: Antennal flagellum (Fig. 2) with only a single sensilla coeloconica on flagellomere 1; flagellomere 10 very short, much narrower than others; plume well developed, extending past flagellomere 12; lengths of flagellomeres in proportion of 43-15-16-15-15-16-16-16-12-10-26-22-24; antennal ratio 0.44. Palpus with smaller sensory pit on segment 3. Mandible vestigial, without teeth. Legs with small equal sized claws with bent bifid tips. Wing narrower, with 2 radial cells and M1 barely visible at midportion; costal ratio 0.57. Genitalia (Fig. 8) short, reduced; sternite 9 with shallow caudomedial excavation; tergite 9 difficult to discern due to distortion, without apicolateral processes, cerci large, prominent, bearing large apical setae. Gonocoxite short, broad, covered with setae; gonostylus slightly longer than gonocoxite, tapering distally from base with broader tip, rounded apex with single, small, well developed tooth. Aedeagus somewhat crushed, broader than long, tip broadly rounded with slight medial concavity; small lateral, lobelike prongs; basal arm more heavily sclerotized than main portion. Parameres separate, heavily sclerotized; a small curved basal arm set at nearly a right angle to main portion; distal portion straight with rounded slightly bulbous tip.

Type material.—Holotype male, allotype female, two female paratypes labelled "SRI LANKA: Bad. Dist., 5 mi E Mahiyangana Hasalaka, 200 feet, 16 November 1974, Collectors: C. Gans, P. Fernando, S. Farook"; holotype, allotype, one paratype deposited in National Museum of Natural History (USNM), one paratype deposited in Canadian National Collection, Ottawa (CNCI).

Etymology.—Named for one of the collectors, Carl Gans, a world renowned herpetologist with the University of Michigan.

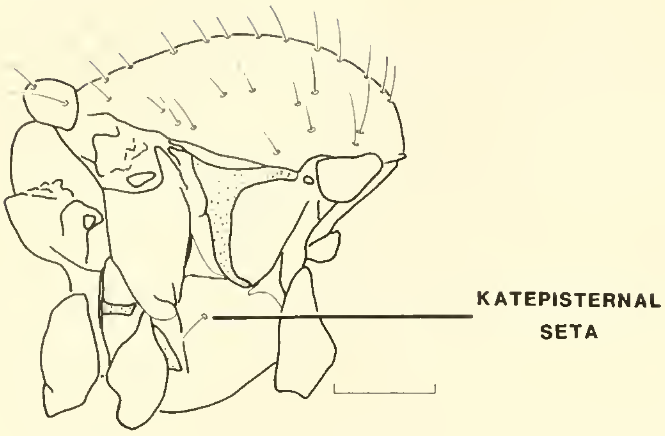
Phylogenetic relationships.—Proposing and recognizing new taxa above the species level should generally be within a context of an understanding of cladistic relationships (Wiley 1981). As such, we have examined the phylogenetic placement of *Sinhalohelea* within the Ceratopogonidae.

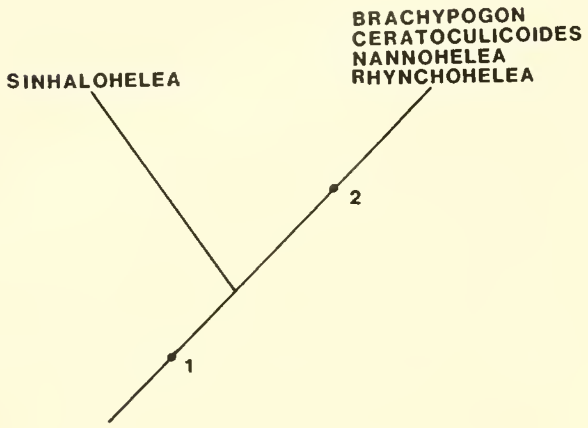
Our interpretation of character state polarity follows the cladistic principle of outgroup comparison discussed elsewhere by Borkent (1984). To obtain a better understanding of character state polarity and distributions, we have examined virtually every ceratopogonid genus with the exception of recently described ones mentioned above or a few monotypic genera based upon a few specimens housed in distant museums. In addition, examples of all other families within the Culicomorpha were also examined.

The following provides a character analysis in which the number corresponds to our concluding cladogram in Fig. 10.

1. Katepisternal setae absent (plesiomorphic); at least one katepisternal seta present (apomorphic) (Fig. 9).

Within the Ceratopogonidae, the apomorphic state is present in only a few other taxa. Species of *Leptoconops* have setae on the lateral and ventral portions of the katepisternum. *Phaenobezzia, Paryphoconus, Johannsenomyia* and *Mackerrasomyia* also have katepisternal setae. However within





Figs. 9–10. Fig. 9. Lateral view of thorax of a male *Brachypogon* (*Isohelea*). Scale = 0.1 mm. Fig. 10. Cladogram showing relationship of *Sinhalohelea* to some other Ceratopogonidae. Numbers refer to character states discussed in text.

the tribe Ceratopogonini the condition is unique and katepisternal setae are lacking in immediate outgroups (Borkent et al. 1987).

In the Culicomorpha, katepisternal setae are otherwise present in the Culicidae, Chaoboridae, some Dixidae and some Chironomidae. We have only seen one Simuliidae with a single lateral katepisternal seta (*Parasimulium crosskeyi* Peterson).

Even though members of *Leptoconops,* as the earliest lineage of Ceratopogonidae, also have katepisternal setae, we consider this to be independently derived. Alternatively, it is possible that the presence of katepisternal setae is plesiomorphic within the Culicomorpha. In that case, the presence of the setae in the group under consideration here would still be considered derived (on the basis of successive outgroup comparisons) but perhaps representing an atavistic reacquisition of the character.

2. Male antennal flagellomeres separate (plesiomorphic); flagellomeres 5–11 fused (apomorphic).

Within the Ceratopogonidae, fused male flagellomeres occur in some other genera but never in the same configuration as that described here. In all these other taxa flagellomere 11 is always free, indicating that the above fusion of flagellomeres 5–11 is correctly interpreted as a synapomorphy grouping *Ceratoculicoides, Brachypogon, Nannohelea* and *Rhynchohelea.*

Further fusion of flagellomeres 2–5 occurs in all known *Brachypogon* and may be a synapomorphy uniting species of that genus. The male of *Rhynchohelea* is unfortunately not known and therefore the character state cannot yet be appraised for this genus.

The appraisal of this character for *Nannohelea* is complicated by a reduction in the number of flagellomeres. In *N. bourioni* (Clastrier), 8 flagellomeres are present but 5 and 6 are fused (pers. obs.). From the elongate appearance of the terminal three flagellomeres, we assume that these are homologous to flagellomeres 11–13 of most other ceratopogonids. Hence, the fusion of flagellomeres 5 and 6 in *N. bourioni* probably indicates a homologous character state of fusion of flagellomere 11 with previous flagellomeres. If flagellomere 5 of *N. bourioni* is homologous to flagellomere 5 of other ceratopogonids, the data would indicate that *N. bourioni* has fused flagellomeres 5–11 but that these are markedly reduced.

The remaining three species of *Nannohelea* (Grogan and Wirth, 1990) have only 7 flagellomeres with the terminal 3 elongate. In at least two of these (*N. tamil* Grogan and Wirth, *N. clastrieri* Grogan and Wirth) the third last flagellomere has at least a double row of elongate setae arranged near its base (Grogan and Wirth 1980, 1990). In other ceratopogonids with a full complement of 13 flagellomeres, flagellomere 11 has only a single row of basal elongate setae. The double row in these *Nannohelea* species indicates that flagellomere 5 is actually flagellomere 11 fused with at least one more basal flagellomere.

Fusion of antennal flagellomeres also occurs in a few, certainly derived Chironomidae (i.e. well within the family) but is otherwise unknown within the Culicomorpha.

Conclusion.—The phylogenetic position of *Sinhalohelea* as the sister group of *Brachypogon* + *Rhynchohelea* + *Nannohelea* + *Ceratoculicoides* justifies its recognition as a new genus. Although its present monotypic status ensures that *Sinhalohelea* is monophyletic, we are presently unable to suggest an autapomorphy for the genus. Perhaps future investigations of the phylogenetic relationships between the genera of the Ceratopogonini (Borkent, in prep.) will allow for further interpretation of characters which now appear markedly homoplastic (i.e. number of radial cells; relative length of costa; presence or absence of apicolateral processes).

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